FACT SHEET

L-1235

6-17-74
4m
JW

CALCULATING OWNERSHIP COSTS

Ronald D. Kay and Wayne A. Hayenga*

Ownership costs, or the fixed costs associated with owning a depreciable asset, are often a large part of the total costs incurred in owning and using farm machinery and buildings. These costs are usually computed on an annual basis with *depreciation, interest, taxes, insurance* and some types of *repairs* making up the major part of ownership costs. Once calculated, annual ownership cost can be used to determine fixed cost per unit of output and, along with an estimate of operating or variable costs, can be used to determine profitability of a proposed investment using several types of investment analysis techniques. (For additional information see L-1093, *Break-Even Analysis,* L-1092, *Partial Budgeting* and L-1091, *Capital Budgeting Methods,* Texas Agricultural Extension Service.)

The Traditional Method

The depreciation component of ownership costs is normally calculated using the straight-line method. With this method ownership costs are assumed to be the same for each year so, in effect, one considers an "average" annual ownership cost. An interest charge is included in ownership costs in all cases regardless of whether or not a loan was, or will be, used to acquire the asset. This is justified on the basis of an "opportunity cost" which is a return the money tied up in the asset would have received from investment in its most profitable alternative use. An opportunity cost interest rate is the rate of return expected from investing in the best alternative investment, possibly with some adjustment depending on the degree of risk associated with the alternative investment. If borrowed money is used to acquire the asset, the interest rate charged on the loan would represent a minimum opportunity rate of return since it represents an actual cash cost.

*Assistant professor, Department of Agricultural Economics and Rural Sociology, Texas A&M University; and economist-agribusiness, Texas Agricultural Extension Service, The Texas A&M University System.

Traditionally the annual interest charge has been computed on the "average value" of the asset rather than the original cost, with the average value calculated by: $\frac{\text{cost} + \text{salvage value}}{2}$. This procedure has been used because it represents the "average" remaining value over the asset's useful life. Since the asset declines in value the investment in the asset also declines, so it would not be appropriate to assume an interest charge on the full original cost each year. The purpose of including the interest charge is to insure that the calculated ownership costs fully cover all costs including the returns possible from the next best alternative investment.

However, the average value method of calculating the annual interest charge does not result in a true value in terms of opportunity costs. Assume a $10,000 investment in an asset with a useful life of five years, a salvage value of $2,000 and an opportunity rate of return of 6 percent. The $10,000 invested in the alternative investment at 6 percent compound interest would be worth $13,382 after five years. This is the amount which the combined annual depreciation and interest charges must return over the five-year period in addition to housing, taxes and insurance to assure that they reflect true ownership costs.

Using straight line depreciation and the average value method of calculating the interest charge indicated above, there would be a $1,600 annual charge for depreciation and $360 for interest for a total annual ownership cost of $1,960. Assuming that this annual ownership charge is received at the end of each year and reinvested at 6 percent annually compounded interest, only $13,049 would be recovered at the end of five years (including recovery of salvage value). This should be compared with the $13,382 total opportunity cost, showing that the straight line method understates the true ownership cost. In general, the smaller the salvage value for a given investment, the greater the discrepancy between the two amounts.

Texas Agricultural Extension Service • The Texas A&M University System • John E. Hutchison, Director • College Station

A More Accurate Method

To accurately account for the opportunity cost of the investment, the annual charge for depreciation and interest must be an amount which, when invested at the opportunity rate of return for the remaining life of the asset and added to the salvage value recovered at the end of the useful life, will equal the amount which could have been obtained by investing in an alternative investment. The annual charge which will meet this criterion can be found by using the formula:

$$\text{Annual charge} = \frac{C(1+r)^n - SV}{((1+r)^n - 1)/r}$$

where C = cost of the asset

SV = salvage value

n = useful life

r = opportunity rate of return

The numerator is the future value of the alternative investment at compound interest for the life of the asset less salvage value, if any. The denominator is the factor for determining the future value of an annual annuity received at the end of each year for n years.

Using this formula and applying it to the previous example, the annual charge is computed as follows:

$$\frac{10{,}000\,(1.06)^5 - 2{,}000}{((1.06)^5 - 1)/.06} = \$2{,}019$$

If the $2,019 is received at the end of each one of the five years and invested at 6 percent compound interest for the remaining years, the total accumulated amount will be $11,382. Adding the $2,000 salvage value which is recovered at the end of the fifth year increases the total to $13,382, which is just equivalent to investing the $10,000 at 6 percent compound interest for the five years.

Easy-to-Use Tables

The coefficients in the tables were developed as an aid in computing annual ownership cost of assets. But the resulting amount has another useful interpretation—it is also the annual return above all cash expenses (excluding interest on any loan) which is needed to justify purchasing a depreciable asset. If the asset in the example returns $2,019 per year above cash expenses to cover such costs as property taxes, insurance, operating repairs, fuel and lubrication, it will allow for recovering its cost through depreciation and receiving a return on the investment equal to the rate of return selected. Discounting this 5-year flow of $2,019 in annual net returns, and the salvage value using the same opportunity interest rate, gives a present value just equal to the purchase price.

This interpretation of the annual ownership charge for depreciation and interest may be useful to farmers, ranchers and agribusinessmen. It may be easier and more common for managers to think in terms of returns *above cash expenses* when contemplating an investment, rather than calculating total ownership costs of an asset.

The following tables were developed using the above formula for each of several interest charges which represent an "opportunity rate of return" on an assumed $1 investment. To determine ownership costs, the tables can be used in the following manner: (1) find the table for your opportunity rate of return, (2) from this table find the number which corresponds to both the *estimated useful life* and *salvage value* (where salvage value is shown as a percentage of purchase price) and (3) multiply this coefficient by the purchase price of the asset. The resulting value is the annual charge for the depreciation and interest components of ownership costs. Using the earlier example of a $10,000 asset with a 5-year useful life and a $2,000 salvage value, we would use Table 1. Thus, the coefficient for 5 years and 20% salvage value is 0.2019. Multiplying this factor by the purchase price of $10,000 gives an annual charge of $2,019.

Use of the coefficients from the tables results in higher annual ownership costs for depreciation and interest than the "average value" method. The difference is about ½ of 1 percent at the 6 percent interest rate, and over 1 percent at the 10 percent opportunity rate of return. At higher interest rates there are larger differences, and for any single interest rate the difference becomes larger with smaller salvage values.

Table 1. Annual ownership cost for depreciation and interest per dollar of purchase price—6 percent interest.

Useful life (yrs.)	Salvage Value as Percent of Purchase Price						
	0%	5%	10%	15%	20%	25%	33⅓ %
1	1.0600	1.0100	0.9600	0.9100	0.8600	0.8100	0.7267
2	0.5454	0.5212	0.4969	0.4726	0.4483	0.4241	0.3836
3	0.3741	0.3584	0.3427	0.3270	0.3113	0.2956	0.2694
4	0.2886	0.2772	0.2657	0.2543	0.2429	0.2314	0.2124
5	0.2374	0.2285	0.2197	0.2108	0.2019	0.1930	0.1783
6	0.2034	0.1962	0.1890	0.1819	0.1747	0.1675	0.1556
7	0.1791	0.1732	0.1672	0.1613	0.1553	0.1493	0.1394
8	0.1610	0.1560	0.1509	0.1469	0.1408	0.1358	0.1274
9	0.1470	0.1427	0.1383	0.1340	0.1296	0.1253	0.1180
10	0.1359	0.1321	0.1283	0.1245	0.1207	0.1169	0.1106
15	0.1030	0.1008	0.0987	0.0965	0.0944	0.0922	0.0886
20	0.0872	0.0858	0.0845	0.0831	0.0817	0.0804	0.0781
25	0.0782	0.0773	0.0764	0.0755	0.0746	0.0737	0.0722

Table 2. Annual ownership cost for depreciation and interest per dollar or purchase price—7 percent interest.

Useful life (yrs.)	Salvage Value as Percent of Purchase Price						
	0%	5%	10%	15%	20%	25%	33⅓ %
1	1.0700	1.0200	0.9700	0.9200	0.8700	0.8200	0.7367
2	0.5531	0.5289	0.5048	0.4806	0.4565	0.4323	0.3921
3	0.3810	0.3655	0.3499	0.3344	0.3188	0.3033	0.2774
4	0.2952	0.2840	0.2727	0.2614	0.2502	0.2389	0.2202
5	0.2439	0.2352	0.2265	0.2178	0.2091	0.2004	0.1859
6	0.2098	0.2028	0.1958	0.1888	0.1818	0.1748	0.1632
7	0.1856	0.1798	0.1740	0.1682	0.1624	0.1567	0.1470
8	0.1675	0.1626	0.1577	0.1528	0.1480	0.1431	0.1350
9	0.1535	0.1493	0.1451	0.1410	0.1368	0.1326	0.1257
10	0.1424	0.1388	0.1351	0.1315	0.1279	0.1243	0.1183
15	0.1098	0.1078	0.1058	0.1038	0.1018	0.0998	0.0965
20	0.0944	0.0932	0.0920	0.0907	0.0895	0.0883	0.0863
25	0.0858	0.0850	0.0842	0.0834	0.0826	0.0819	0.0805

Table 3. Annual ownership cost for depreciation and interest per dollar of purchase price—8 percent interest.

Useful life (yrs.)	Salvage Value as Percent of Purchase Price						
	0%	5%	10%	15%	20%	25%	33⅓ %
1	1.0800	1.0300	0.9800	0.9300	0.8800	0.8300	0.7467
2	0.5608	0.5367	0.5127	0.4887	0.4646	0.4406	0.4005
3	0.3880	0.3726	0.3572	0.3418	0.3264	0.3110	0.2854
4	0.3019	0.2908	0.2797	0.2686	0.2575	0.2464	0.2280
5	0.2505	0.2419	0.2334	0.2249	0.2164	0.2078	0.1936
6	0.2163	0.2095	0.2027	0.1959	0.1891	0.1822	0.1709
7	0.1921	0.1865	0.1809	0.1753	0.1697	0.1641	0.1547
8	0.1740	0.1693	0.1646	0.1599	0.1552	0.1505	0.1427
9	0.1601	0.1561	0.1521	0.1481	0.1441	0.1401	0.1339
10	0.1490	0.1456	0.1421	0.1387	0.1352	0.1318	0.1260
15	0.1168	0.1150	0.1131	0.1113	0.1095	0.1076	0.1046
20	0.1019	0.1008	0.0997	0.0986	0.0975	0.0964	0.0946
25	0.0937	0.0930	0.0923	0.0916	0.0909	0.0903	0.0891

Table 4. Annual ownership cost for depreciation and interest per dollar of purchase price—10 percent interest.

Useful life (yrs.)	Salvage Value as Percent of Purchase Price						
	0%	5%	10%	15%	20%	25%	33⅓ %
1	1.1000	1.0500	1.0000	0.9500	0.9000	0.8500	0.7667
2	0.5762	0.5524	0.5286	0.5048	0.4810	0.4571	0.4175
3	0.4021	0.3870	0.3719	0.3568	0.3417	0.3266	0.3014
4	0.3155	0.3047	0.2939	0.2832	0.2724	0.2616	0.2437
5	0.2638	0.2556	0.2474	0.2392	0.2310	0.2228	0.2092
6	0.2296	0.2231	0.2167	0.2102	0.2037	0.1972	0.1864
7	0.2054	0.2001	0.1949	0.1896	0.1843	0.1791	0.1703
8	0.1874	0.1831	0.1787	0.1743	0.1700	0.1656	0.1583
9	0.1736	0.1700	0.1663	0.1626	0.1589	0.1552	0.1491
10	0.1627	0.1596	0.1565	0.1533	0.1502	0.1471	0.1418
15	0.1315	0.1299	0.1283	0.1268	0.1252	0.1236	0.1210
20	0.1175	0.1166	0.1157	0.1148	0.1140	0.1131	0.1116
25	0.1102	0.1097	0.1092	0.1086	0.1081	0.1076	0.1068

Table 5. Annual ownership cost for depreciation and interest per dollar of purchase price—12 percent interest.

Useful life (yrs.)	Salvage Value as Percent of Purchase Price						
	0%	5%	10%	15%	20%	25%	33⅓ %
1	1.1200	1.0700	1.0200	0.9700	0.9200	0.8700	0.7867
2	0.5917	0.5681	0.5445	0.5209	0.4974	0.4738	0.4345
3	0.4163	0.4015	0.3867	0.3719	0.3571	0.3423	0.3176
4	0.3292	0.3188	0.3083	0.2978	0.2874	0.2769	0.2595
5	0.2774	0.2695	0.2617	0.2538	0.2459	0.2381	0.2249
6	0.2432	0.2371	0.2309	0.2247	0.2186	0.2124	0.2022
7	0.2191	0.2142	0.2092	0.2043	0.1993	0.1943	0.1861
8	0.2013	0.1972	0.1932	0.1891	0.1850	0.1810	0.1742
9	0.1877	0.1843	0.1809	0.1775	0.1741	0.1708	0.1651
10	0.1770	0.1741	0.1713	0.1684	0.1656	0.1627	0.1580
15	0.1468	0.1455	0.1441	0.1428	0.1415	0.1401	0.1379
20	0.1339	0.1332	0.1325	0.1318	0.1311	0.1304	0.1293
25	0.1275	0.1271	0.1267	0.1264	0.1260	0.1256	0.1250

Table 6. Annual ownership cost for depreciation and interest per dollar of purchase price—15 percent interest.

Useful life (yrs.)	Salvage Value as Percent of Purchase Price						
	0%	5%	10%	15%	20%	25%	33⅓ %
1	1.1500	1.1000	1.0500	1.0000	0.9500	0.9000	0.8167
2	0.6151	0.5919	0.5686	0.5453	0.5221	0.4988	0.4601
3	0.4380	0.4236	0.4092	0.3948	0.3804	0.3660	0.3420
4	0.3503	0.3402	0.3302	0.3202	0.3102	0.3002	0.2835
5	0.2983	0.2909	0.2835	0.2761	0.2687	0.2612	0.2489
6	0.2642	0.2585	0.2528	0.2471	0.2414	0.2357	0.2262
7	0.2404	0.2358	0.2313	0.2268	0.2223	0.2178	0.2102
8	0.2229	0.2192	0.2156	0.2119	0.2083	0.2046	0.1986
9	0.2096	0.2066	0.2036	0.2006	0.1977	0.1947	0.1897
10	0.1993	0.1968	0.1943	0.1919	0.1894	0.1869	0.1828
15	0.1710	0.1700	0.1689	0.1679	0.1668	0.1658	0.1640
20	0.1598	0.1593	0.1588	0.1583	0.1578	0.1573	0.1565
25	0.1547	0.1545	0.1542	0.1540	0.1538	0.1535	0.1531

Table 7. Annual ownership cost for depreciation and interest per dollar of purchase price—20 percent interest.

Useful life (yrs.)	Salvage Value as Percent of Purchase Price						
	0%	5%	10%	15%	20%	25%	33⅓%
1	1.2000	1.1500	1.1000	1.0500	1.0000	0.9500	0.8667
2	0.6545	0.6318	0.6091	0.5864	0.5636	0.5409	0.5030
3	0.4747	0.4610	0.4473	0.4335	0.4198	0.4060	0.3832
4	0.3863	0.3770	0.3677	0.3583	0.3490	0.3397	0.3242
5	0.3344	0.3277	0.3209	0.3142	0.3075	0.3008	0.2896
6	0.3007	0.2957	0.2906	0.2856	0.2806	0.2755	0.2671
7	0.2774	0.2736	0.2697	0.2658	0.2619	0.2581	0.2516
8	0.2606	0.2576	0.2545	0.2515	0.2485	0.2455	0.2404
9	0.2481	0.2457	0.2433	0.2409	0.2385	0.2361	0.2321
10	0.2385	0.2366	0.2347	0.2327	0.2308	0.2289	0.2257
15	0.2139	0.2132	0.2125	0.2118	0.2111	0.2104	0.2093
20	0.2054	0.2051	0.2048	0.2046	0.2043	0.2040	0.2036
25	0.2021	0.2020	0.2019	0.2018	0.2017	0.2016	0.2014

Table 8. Annual ownership cost for depreciation and interest per dollar of purchase price—25 percent interest.

Useful life (yrs.)	Salvage Value as Percent of Purchase Price						
	0%	5%	10%	15%	20%	25%	33⅓%
1	1.2500	1.2000	1.1500	1.1000	1.0500	1.0000	0.9167
2	0.6944	0.6722	0.6500	0.6278	0.6056	0.5833	0.5463
3	0.5123	0.4992	0.4861	0.4729	0.4598	0.4467	0.4249
4	0.4234	0.4148	0.4061	0.3974	0.3888	0.3801	0.3656
5	0.3719	0.3658	0.3597	0.3536	0.3475	0.3414	0.3312
6	0.3388	0.3344	0.3299	0.3255	0.3211	0.3166	0.3092
7	0.3163	0.3130	0.3097	0.3064	0.3031	0.2998	0.2942
8	0.3004	0.2979	0.2954	0.2928	0.2903	0.2878	0.2836
9	0.2888	0.2868	0.2849	0.2829	0.2810	0.2791	0.2758
10	0.2801	0.2786	0.2771	0.2756	0.2741	0.2726	0.2701
15	0.2591	0.2587	0.2582	0.2578	0.2573	0.2568	0.2561
20	0.2529	0.2528	0.2526	0.2525	0.2523	0.2522	0.2519
25	0.2509	0.2509	0.2509	0.2508	0.2508	0.2507	0.2506

This Fast Sheet is one in a series on investment analysis. Others in the series include *Investment Analysis—Partial Budget Method* (L-1092, Texas Agricultural Extension Service), *Investment Analysis—Break-Even Method* (L-1093, Texas Agricultural Extension Service), and *Investment Analysis—Capital Budgeting Methods* (L-1091, Texas Agricultural Extension Service).

Cooperative Extension Work in Agriculture and Home Economics, The Texas A&M University System and the United States Department of Agriculture cooperating. Distributed in furtherance of the Acts of Congress of May 8, 1914, as amended, and June 30, 1914.
4M—4-74